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Nuclear Energy and the Future

By Sir Francis Simon

POWER consumption and productivity go hand in hand and it is no exaggeration to say that standards of living are mainly determined by the level of power consumption. Power is the decisive factor for our future. What are the prospects that we will always have an abundant supply at our disposal? A new source of power has recently been unloosed, nuclear energy, and one wonders how it will influence our future power pattern.

CONVENTIONAL POWER SOURCES

The law of conservation of energy tells us that power cannot be created. We can obtain it only from existing energy stores of which there are many obvious ones in nature: primarily sunlight itself, and of course wind, falling water, the tides, the waves and many others. The energy in each of these sources is far greater than our total consumption but in practically all of them it is stored in a not very " concentrated " form and therefore very big installations would be needed to utilize it. In addition, most of these sources are of an intermittent nature, and big and costly storage plants would also be required. Water power is perhaps something of an exception in those relatively few places where nature has presented us with mountainous catchment areas but it can be discounted in an over-all picture.

Falling water and wind have both been used for a very long time in small-scale plants, as for instance in the grinding of grain. The Industrial Revolution, however, could not possibly have been based on wind and water; it had to wait until we had learnt to utilize by means of the steam engine the highly concentrated chemical energy stored in coal. It should, however, be noted that we do not know even now how to convert the chemical energy represented by the oxidation of coal *directly* into mechanical or electrical energy. In principle this can be done by a hypothetical device called the " fuel cell " but, up to the present, chemical energy must first be converted into heat at high temperature and this into mechanical energy. Although the efficiency of conversion of the energy originally contained in the coal into mechanical energy has

been increasing continuously, the average present-day efficiency of, say, the British Electricity Authority's power stations is not more than 24 per cent.

Considering the over-all picture we can state that present-day economies are based essentially on the fuels: coal, oil and natural gas. Of these, coal is by far the most important source of energy. It is true that in the United States oil and, to some extent, natural gas, are also significant at present. However, as the reserves of these fuels are comparatively small, this is really only a passing phase. It would be unwise, and in the long run uneconomic, for Britain to rely on oil for any essential part of her power supplies.

THE ADVENT OF NUCLEAR ENERGY

Is the new power source, nuclear energy, likely to be the starting point of a new industrial revolution? To answer this question we must consider some of its characteristics. Chemical energy resides in the outer part of the atoms, in the shell of electrons surrounding the nucleus, and is set free when these electrons are re-arranged among the reacting atoms. Nuclear energy resides in the innermost part of the atom, the nucleus, which again consists of a number of constituents—neutrons and protons. The forces between these particles are very much bigger than the chemical forces and this explains two things: first, that it is much more difficult to make re-arrangements and, secondly, that once it has been done the energies concerned are vastly greater. In fact, the energies stored up are of the order of some million times larger than those in chemical reactions.

The relativity theory makes it possible to calculate from the masses of the nuclei how much energy can be developed by inter-nuclear re-arrangements, and it turns out that there are two ways in which energy can be obtained: either by fission of the heavy nuclei or by fusion of light nuclei, the so-called thermo-nuclear reactions. So far it has been possible to make controlled use only of the fission processes, while thermo-nuclear reactions have been achieved only in uncontrolled conditions—in the hydrogen bomb. As in the case of chemical energy, it has not been possible to convert nuclear energy directly into either mechanical or electrical energy, but only into disordered heat energy. To convert this heat into useful ordered energy, we have to use equipment similar to that in conventional power stations, and therefore can only obtain the same low over-all efficiencies.

In judging the potentialities of this new source of power there are several points to bear in mind. First, the weight of the "fuel" is negligible. Secondly, nuclear reactors have a minimum size and will be quite uneconomic for outputs as small as, say, a few hundred kilowatts. Thirdly, each reactor has to be surrounded by a shield in order to protect the operators from the very penetrating radiations which are released as an integral part of the reaction. Thus we can at once dismiss some applications for which nuclear power will not be particularly suited. For example, the negligible weight of the fuel makes one think of nuclear power for transport, but the need of a biological shield and the inefficiency of small-scale power units make it quite unsuitable for motor cars. Adaptation of nuclear plant for very large aircraft is a possibility, but is not likely to occur in the near future. (However, nuclear propulsion of large ships is a very promising field; submarines, military and civilian alike, would profit particularly as no oxygen is needed.) Again, it is difficult to imagine that nuclear energy will have any particular advantages for the provision of industrial heat, while any small-scale use, as for instance the *direct* application for heating of houses, is quite out of the question.

What then will be the main applications of our new form of energy? First and foremost, nuclear power will be used to drive big power stations of the same order of size as those burning the conventional fuels. This application will naturally be considered only if it offers advantages, either because nuclear power is cheaper or because there is not a sufficient supply of conventional fuels to see us through. Nuclear energy will also make possible the provision of large or medium sized power stations in out of the way places, to which the transport of conventional fuels is either impossible or prohibitively expensive. Under-developed countries are often under-developed just because they have no power available, and the impact of nuclear energy on them is bound to be considerable. It might seem at first sight that this particular application is of no great interest to this country, if not actually against our interests, in that it might remove the ground from under our feet by accelerating still further the spread of industrialism over the whole world and so reduce our sources of income. Such an attitude, however, would be quite mistaken; in actual fact the export of nuclear power stations is an ideal example of the kind of export on which this country will have to live in an ever-increasing measure.

BRITAIN'S FUTURE POWER SUPPLIES

In order to discuss the potential usefulness of nuclear power in Britain we must first consider to what extent conventional fuels will be able to supply our needs in the future. Britain's total consumption of coal is slightly over 200 million tons per year and the reserves will last for, say, 200 years at the present rate of consumption. On the other hand, we know that our use of power is much too restricted. The United States, for instance, uses twice as much per head of population as we do, and each worker has three times more power at his disposal than his British counterpart. If Britain wants to compete in world markets in the future, we shall have to increase the amount of mechanization in our industry and that will call for much more power.

At the moment we are a long way behind the United States, although—of course—in a much better position than the world average. However, our main competitors in the near future, Germany and Russia, are working hard to approach American standards and the outlook for the future is most worrying. The Americans count on doubling their power consumption in 25 years and more than trebling their electricity consumption. Even if we only wanted to approach these figures, we would, in 25 years, need at least twice our present coal consumption. Of course, one must be careful not to make too great an extrapolation from figures valid over short periods of time. If, every 25 years, we were to double our consumption of some commodity, the demand would soon reach astronomical figures quite beyond the resources of the earth. In the limit, various factors will force a stop ; nevertheless, we can definitely count on very considerable increases in the demand for fuel. Consider a specific case which is very relevant to our discussion, the amounts of coal which will be needed by our power stations. The White Paper on Nuclear Power[1] gives the following estimates : 1955, 40 million tons ; 1965, 65 million tons ; 1975, 100 million tons per annum.

Where is all this fuel to come from? With the present position in the mines there seems little hope of increasing our coal output significantly in the near future. It looks as if for the next 10 or 20 years we will have to make do with an annual coal production of less than 250 million tons. Moreover, even if we could mine more, it would only mean that our coal resources would be running out still faster. It is true that other

[1] *A Programme of Nuclear Power*, H.M.S.O., Cmd. 9389.

countries like the United States and Russia have much higher stores at their disposal; but a rough survey shows that if the fossil fuels, both coal and oil, were distributed equally between all the countries of the earth, we should all run into a grave shortage by the middle of the next century.

If, however, this country has to rely on its own coal reserves, serious trouble will start very early in the next century. Moreover, besides being the main source of our power, coal and oil serve as essential sources of materials for the chemical and metallurgical industry. The exhaustion of the fossil fuels for *this* reason alone would be a most serious matter, and would necessitate additional efforts to synthesize the often highly complex materials which Nature now provides for us. Thus, it is obvious that this country is vitally interested in the use of nuclear power to supplement and perhaps subsequently replace coal for the generation of electricity.

NUCLEAR PROSPECTS

It is, of course, essential that sufficient nuclear fuel be available. The only primary nuclear fuel is the uranium isotope 235 which is present in ordinary uranium at a concentration of less than 1 per cent. There are secondary fuels such as the main constituent of uranium, the isotope 238, also thorium and a few transuranic elements—like plutonium—which are produced in the fission process. If we had to rely solely on uranium 235, the amount available for really large-scale production of energy would probably not be sufficient to see the world through for more than a few decades. However, the so-called "breeding" process makes possible the use of the abundant uranium isotope 238 and although this build up of additional fuel is a slow process, in the long run it will permit large-scale power production for a considerable period. It is estimated that the total energy available in accessible uranium ores is about 20 times as great as that in the conventional fuels.

There is no need to discuss here in any detail the underlying physical processes which make possible the release of nuclear energy, nor the design of nuclear reactors. This can be omitted all the more easily as an excellent account of these matters for the layman is contained in the recently published White Paper mentioned above, which should be studied carefully by anybody interested in the future of nuclear power. Here, I wish only to emphasize that there are a great variety of schemes for releasing the energy residing in the nucleus.

The various types of reactors will vary in the choice of the fissile material and its concentration and, most important, in the amount of fissile material that has to be invested. They will vary also in the size of the chemical plants which are needed to deal with the fission products and re-process the unused fissile material. Some will need separation plants to enrich the uranium 235 isotopes, others require auxiliary plants to supply heavy water. All this means that there is not a single clear-cut way which one has to follow, but very many, and we cannot yet say which of them will be the most successful. Several schemes will have to be started in parallel and while it is now certain that one or the other of them will lead to a feasible power system, it will take many years to find out which is the most economical.

Within the next few years we shall certainly see a number of nuclear power plants producing electricity, but this will not mean that the age of atomic power has really arrived. We should not forget that so far no one has any experience in running nuclear power reactors under realistic conditions; reactors are in about the same state as aeroplanes were when Blériot first crossed the English Channel. There is a long way ahead of us, strewn with many difficulties and disappointments, but leading to enormous opportunities which must be grasped with vigour.

THE TIME SCALE[1]

One important consideration is the cost of " nuclear " electricity. Although obviously nothing very definite can yet be said, it is probable that the price of fuel will be relatively unimportant. On the other hand, it is certain that the capital cost of a nuclear power system will be considerably higher than that of a conventional one, due mainly to its much greater complexity. However, let us be optimistic and suppose that after a development period of 15 to 20 years, nuclear electricity will cost about the same as electricity from coal. The White Paper is more specific in its predictions, foreseeing prices for " nuclear " electricity from even the first plants which would be practically the same as for " coal " electricity. This forecast, however, is arrived at by assuming a non-specified—but obviously considerable—price for the by-product plutonium and should not be taken too seriously.

[1] See also F. E. Simon, " Power from Atomic Energy " in *Atomic Energy, a Survey*, Taylor and Francis, London, 1954.

How long will it be before nuclear energy is making really worth-while contributions to our power system? First, we must realize that to build up a nuclear electricity system comparable to, say, our present generating capacity (i.e. about 20,000 megawatts), will involve an expenditure of the order of £3,000 millions. As only a certain amount of capital will be available for these developments, and as coal fired stations will still be built because of their lower cost, it can hardly be less than 20 to 25 years before such a nuclear system is completed. Adding this to the development period, we cannot expect such a system to function before the end of the century. On the other hand, the demand for electricity will by then be very much bigger than it is now, at least it will be if Britain is still a leading industrial country. If we consider in addition that only about one-sixth of the fuel consumed at present goes into electricity stations, it is clear that even at the end of the century the atomic age will hardly have got beyond its infancy. Indeed, it will probably be about the middle of the next century before we can count on nuclear fission looking after most of our power needs.

In the June number of "Nucleonics" last year, J. A. Lane discussed the expected growth of the United States nuclear power industry and arrives at similar figures. His estimate is that "in the year 2000 nuclear plants will contribute about one-third of the total electrical output (and about 10 per cent. of the total U.S. power). The integrated contribution of nuclear fuels for the 40-year period will amount to less than 5 per cent. of the total fuel consumed." The British White Paper is more optimistic. It estimates that by 1965 nuclear stations will be able to contribute 1,500–2,000 megawatts to the grid and that as early as 1975 their capacity will be between 10 and 15,000 megawatts out of a total of about 55–60,000; as they are intended to provide the base load they might replace about 30–40 million tons of coal per annum. However, the authors of the report stress repeatedly the wide margin of uncertainty involved in their calculations and emphasize that the actual figures achieved may differ considerably.

In any case, it is clear that coal will still be the backbone of our power supplies for the next few decades. Of course, a lot of effort will have to go into nuclear development and quite rightly so. If the White Paper is a bit too optimistic, it is something most of us would not find fault with. We have, fortunately, an enthusiastic and most able team in our Atomic Energy Authority and if they were not optimistic, they probably

would not be the right people for the job. There is, nevertheless, the danger of other factors being overlooked which are equally important and which do not possess such capable and energetic champions to press their claims. A chain is never stronger than its weakest link and there are unfortunately many weaknesses in fields which are intimately connected with the success or failure of our nuclear venture. These must be discussed if one wants to get a balanced picture of the future of nuclear power. One such factor which I have in mind is the saving of coal by utilizing it properly, in contradistinction to its replacement by nuclear energy.

POWER STATION EFFICIENCY

As a case in point, I would like to draw attention to the data concerning the efficiency of the coal-powered stations on which the calculations of the White Paper are based, figures which obviously must have had the approval of the British Electricity Authority: " The best modern stations already have a thermal efficiency of 30 per cent., and it is possible that the *average* efficiency in 1975 might be as high as 30–32 per cent.". These figures are very considerably below those which American utility companies estimate for their future power stations. Although conditions in both countries are not strictly comparable, it is clear that it should be possible to run our future power plants at higher efficiencies than those projected in the White Paper. By 1975 we could in this way save approximately half the amount of coal which under the White Paper plan will be achieved by changing over to nuclear energy.

Why should our power stations lag behind American ones? Is it that our firms do not undertake research on a big enough scale? One of the American builders of turbo-generators, although not the biggest, has just announced the setting up of three new research laboratories, one for fundamental metallurgy, one for developing alloys for higher temperatures and another multi-million dollar project for steam turbine design. This particular firm, it is true, produces twice as much generating capacity as all British firms together; perhaps our firms should combine in setting up a modern research department which would enable them to reach American efficiency standards. However, the real trouble seems to me that their main customer, the British Electricity Authority, is run by an administration which concentrates its interest on the purely electrical aspects and which, in addition, is not really research minded.

To try to grasp more and more capital for building power stations is all right up to a point. Insufficient interest, however, is taken in the problems of coal economy, and the rather low efficiencies given for the power stations to be commissioned in the future is only one of many examples. Another and most important one concerns the low temperature heat which at the moment is—unfortunately and inevitably—the biggest product of both conventional and nuclear power stations. This heat should, of course, be utilized wherever possible for heating houses and for industrial heat. However, this possibility is virtually ignored and in particular no heed is taken of it in the siting of new power stations. Then again, the Authority does not discourage the use of electricity for heating houses and commercial premises; indeed in many of their advertisements they even advocate it. This is wrong not only from the point of view of coal economy, but even more so on account of its influence on the load factor. Much of the heating load occurs at peak hours, and thus the best use is not made of our generating capacity.

PROBLEMS OF COAL ECONOMICS

Whose business is it then to look after these matters? Perhaps it is unfair to expect the electrical engineers to take any action. The Coal Board is mainly occupied with its difficult and complex production problems. There seems to be no high powered authority inside the Ministry of Fuel and Power to keep a jealous eye on our wasting coal reserves and this impression is certainly reinforced by many other observations. It has been rightly pointed out by Sir Ben Lockspeiser, the Secretary of the Department of Scientific and Industrial Research, that Britain is the champion coal waster of the world. Our houses have little thermal insulation and are kept warm by burning coal in most inefficient appliances. If at last some action is going to be taken to introduce more modern equipment, this has been brought about not so much by the desire to stop waste of coal as by the menace of air pollution in our cities.[1] If the Ministry of Fuel and Power would take really

[1] I have dealt in some detail with this aspect of the waste problem, which is a most important one, in the Earl Grey Lecture last year: *Waste, the Threat to our Natural Resources* (King's College, Newcastle-upon-Tyne). Here I would like to refer only to the waste products of nuclear power stations about which the general public seems to be over-anxious. Naturally these waste products must never be released into the open before their activity has become harmless. As, however, their volume is so small, there do not seem to be any great difficulties in storing them in vessels until that time. In actual fact it is easier to avoid the harmful effects of nuclear waste products than those of the conventional fuels, a point which in my opinion favours power production from nuclear energy.

vigorous action in this and related fields of industry, 20–30 million tons of coal per year could be saved without excessive capital investment, and this relatively soon. In addition, much more research should be carried out on more long-term projects, as for instance the fuel cell, which is bound to come some day and will revolutionize coal utilization.

Thus a very substantial fraction of the total amount of coal consumed is wasted, but nevertheless the estimates of future coal consumption which we see so often discussed are all based more or less on the assumption that the waste will continue. However, this waste *must* be cut out if we are to expand our power industry at the required rate, because—quite apart from the pollution problem—it puts an intolerable and unnecessary strain on our resources, natural and financial. The standard of living is determined not by the power consumption per head of population but by what is consumed *usefully*, and these two figures are very different.

It is therefore the duty of the Government to allocate our resources to the best advantage and thus ensure the quickest and most economic reduction of coal consumption. Of course, my remarks do not imply that I advocate going slow with atomic energy, but that a balance has to be struck between the various ways of saving coal. Indeed, in the end the atomic energy project would benefit. It would have time to develop at a healthy rate and also would be able to devote more of its effort to designing nuclear power plant for export.

GENERAL IMPLICATIONS

The implications of these new developments go very much further than the question of coal economy. They are connected by a thousand different threads to the life of the nation. I can cover this field only in a rather cursory manner, although each of the points raises very large issues. First, a question still connected with our power supplies—the degree of utilization of power stations. The load factor of Britain's power stations is at the moment just under 50 per cent. whereas the American figure is slightly more than 75 per cent. If our load factor could be raised even to 66 per cent., three-quarters of our generating capacity would suffice to do the same amount of work. Taking the White Paper figures, this would mean that by 1975 about £1,000 millions could be saved and diverted to productive purposes. I have already mentioned that the load factor is adversely affected by electric heating, but still more important is the fact that most of industry in this

country is not on shift work. Our first nuclear power stations will be used to provide the base load but, with an increasing number of nuclear stations, the time will come when they will also have to supply the ordinary load and therefore work only part time. No country can afford the luxury of installing expensive machinery, in power stations or elsewhere in industry, if it is utilized for only a short part of the day. We should note that our main industrial competitors such as the United States, the U.S.S.R. and Germany are already using shift work on a large scale.

There are many more interconnections between the development of nuclear energy and industry as a whole. This is obvious, as the spending of the large sums we envisage will keep an important part of our industry busy. Indeed, it is no great exaggeration to say that the distribution of the capital and manpower of the whole nation will be involved. An atomic energy project, with all the funds and manpower it needs, side by side with other parts of industry starved of both would be like a modern engine in a " horseless carriage ".

All this will mean a very careful balancing of conflicting claims. Apart from the importance of the various projects, the determining factors will be the demands on capital and manpower. At the moment vast amounts of capital and manpower are tied up in the armaments industry which, to a very large extent, is still wedded to conventional weapons. With their rapidly decreasing usefulness, or so it seems to me, much of this effort could be redistributed to the benefit of those developments which are essential for the future.

SCIENTIFIC MANPOWER

The key rôle in these developments will naturally fall to scientists and technologists. Unfortunately, we do not do enough to foster research ; in particular we have failed to build up a sufficiently strong and balanced community of scientists and technologists.

To give a background : we spend £1,500 millions annually on armaments—and £15 millions for education and training in science and technology at university level. It is obvious that these figures are completely out of balance, especially when we consider that first-class scientists and technologists are essential for creating the most effective equipment for the fighting forces. Sufficient support is forthcoming for research in nuclear physics, but funds are too scarce for other fields of

science. Non-nuclear physics, chemistry and the engineering sciences are all equally important in the development of nuclear power and, of course, more so to the greater part of industry.

Our weakest link is our supply of scientific and technological manpower, which is insufficient to meet the demand. Some very important projects are being starved, while at the same time scientists are drafted into the forces where they are not employed in the best interests of the country. Again, it has often been emphasized that we do not produce enough of the right type of higher technologists owing to the shortcomings of our higher technological education. The lack of science teachers in the schools threatens to starve our supply of scientists at the root and the Ministry of Education is taking notice only after the position has developed to catastrophic dimensions. Nor has the Ministry taken any adequate steps to remedy the fact that too small a percentage of young people are going into science and technology and too many into the arts.

Perhaps the most disquieting aspect is that while the West obviously has not understood that scientific and technological manpower is the most important commodity of this technological age, the Russians have. They have built up a balanced community of scientists and technologists and their annual output is now more than double that of the United States. Their quality does not seem to be inferior to that in the West and, if no serious changes take place very soon, the technological effort of the Communist countries will overtake that of the West within a decade or two. Reverting to our main theme, it would not be at all impossible for the Russians to capture the export market for nuclear power stations, and in this way greatly extend their spheres of influence.

Matters in the modern technological world are becoming more and more interlocked, but there does not seem to be any mechanism which automatically assures a balance between conflicting claims. It is up to the Government to allocate priorities for manpower and capital investments. What we need is an office, probably at ministerial level, which could bring the relevant facts to the notice of the Government and provide a mechanism for putting their decisions into practice. If we can achieve a proper co-ordination without the unpleasant methods of the dictatorial countries, the West certainly need not fear the Russians, but otherwise it looks as if we may lose to them.

CONCLUSIONS

In the beginning I posed the question whether the coming of nuclear power heralds a *new industrial revolution*. Let us survey the outcome of our discussions. It is clear that by the end of the century nuclear energy will have made its mark on our power pattern. The under-developed countries will have felt its impact much earlier, as the provision of small amounts of energy should be possible within a decade or two, although to begin with at a price which might be uneconomic for the more industrialized countries. The middle of next century will probably see the world deriving most of its energy from nuclear sources. By then, if not even very much earlier, means will have been found to bring the so-called thermo-nuclear reactions under control, and these—because of the abundance of the fuels—will assure the world of energy supplies for all time to come.

For the under-developed countries nuclear power will really mean the ushering in of a new era. It will make industrialization possible by tending to equalize the cost of power over the whole world, and so enable industry to set up in places deprived of the conventional fuels. In highly industrial countries, nuclear power will not bring about such spectacular changes but it will give us the assurance that we are no longer dependent on the dwindling stores of conventional fuels. It will eventually bring us relief from the drudgery in the mines, as well as from the dangers of air pollution. It will also offer great opportunities and vast markets for countries which like Britain will have to live by their brain power.

Thus it is obvious that nuclear energy will have a very decisive effect on our way of life. This country can be proud that it possesses in the British Atomic Energy Authority a team of great ability, enterprise and vision. But this is not sufficient. In particular, there are too many who think that nuclear energy is the panacea which will permit us to go on wasting and fumbling as we do now in so many fields. A supreme effort must be made to change this state of affairs. I have tried to outline a few of the points which seem most important not only for the future of nuclear energy, but of the country as a whole.

FRANCIS SIMON.

Oxford.

March, 1955.

The Effectiveness of Bank Rate

THERE have been years since 1939 in which the purchasing power of the pound has declined very little; none in which it has been fully maintained. Whether recent events mean that this process of attrition is finally to be arrested it is too early to judge. What is clear is that we have seen a departure of the first importance in the sphere of monetary policy. For the first time in a generation, it seems, almost exclusive reliance is being placed upon financial controls to restore the disturbed balance of our economy, both internally and externally.

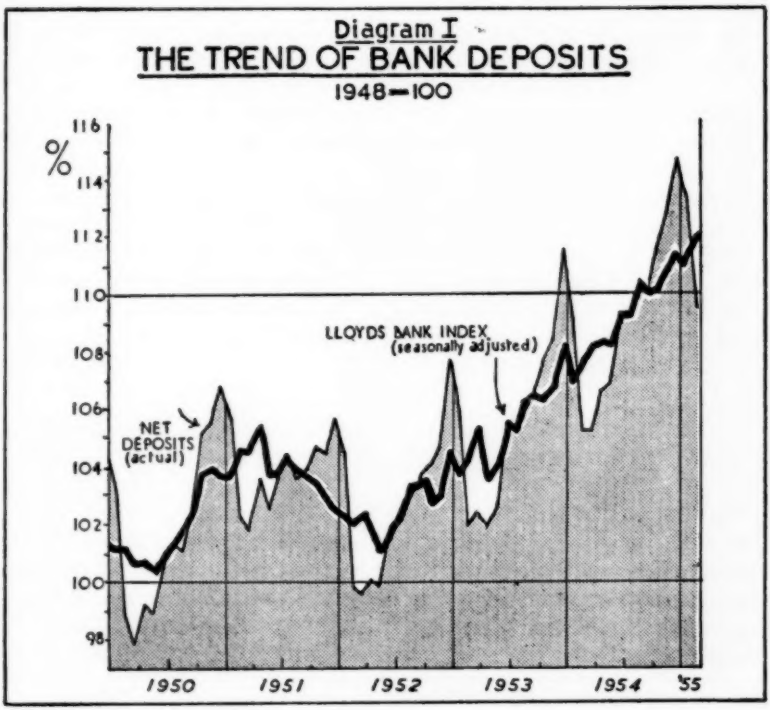
The unpegging of Bank Rate in 1951, after nearly twenty years of 2 per cent., was undoubtedly a major event. But the Bank Rate move was only one among a number of crisis measures which included such stop-gaps as the direct restriction of imports. In the meantime, of course, the machinery of import control has been very largely dismantled and that of consumer rationing completely so. Unless this progress towards a free economy were to be reversed, this leaves only the two financial regulators—budget policy and monetary policy—as the means of keeping the economy on an even keel. At present, it seems that monetary policy is being called upon to do the job alone. One has heard no suggestion that the restraints on credit are to be reinforced by any simultaneous stiffening on the budgetary front. On the contrary, if the widespread expectations of a "popular" budget should be realized, monetary policy will have not only to extirpate any existing excess of demand but also to neutralize a further stimulus to spending arising from tax concessions.

* * *

There is an impression that the unleashing of Bank Rate in 1951 ushered in a new era of monetary tightness which has persisted ever since and has merely been accentuated by the latest moves. That is not the case. It is true that the return to more flexible short-term rates of interest restored to the authorities the power, abandoned under the former system, to regulate the volume of deposits. In the event that power has not, until recent weeks, been exercised. In the first few months of the new régime bank deposits undoubtedly fell, but that was not the result of any downward pressure upon bank cash

reserves exercised through the maintenance of stringent conditions in the money market. Very largely, the contraction in deposits reflected the huge losses of gold that were taking place, as is evident from the fact that the decline began several months before the adoption of the new policies. It was, of course, a salutary change that in 1951–52 (unlike 1947 and 1949) the gold losses did have the deflationary effect on bank deposits which is part of the normal process of correcting an adverse balance of payments. Nevertheless, no sooner had the gold outflow been stemmed than the trend of bank deposits turned upwards again. Ever since, the deposits total has been climbing steadily, raising Lloyds Bank's seasonally adjusted index from 101 in May, 1952, to 112 in February, 1955.

This was possible because Bank Rate, though maintained at higher levels, was never made any more effective, in the



technical sense, than the former 2 per cent. rate. At no time, until the recent moves, has the gap between Bank Rate and the Treasury bill allotment rate narrowed to less than 1 per cent. Any incipient stringency has been relieved, since 1951 as before it, by the intervention of the special buyer, affording assistance at the prevailing market rate. Dearer money, in short, has not in this sense meant tighter money. The additional cash reserves enabling the banks to carry additional deposits have oozed out through a money tap at something like 2⅛ per cent. or 1⅝ per cent., instead of through the former half per cent. money tap—a system in which the gentle tug on the reins is administered by the horse.

To state the fact is not necessarily to criticize the policy. Throughout 1953 and even the greater part of 1954 everything in the garden seemed reasonably lovely, with no more than a few wisps of smoke to suggest that the bonfire of inflation might not have been completely extinguished. It is also true that since 1951 the expansion of the money supply has barely kept pace with that of industrial production and has run very little, if at all, ahead of the growth in the real national income as a whole. That would be more reassuring if there were any evidence that at the outset the money supply was no more than adequate, if 1951 had been characterized by a state of internal and external equilibrium, instead of the worst balance of payments crisis since the war. Fortunately, the present difficulties do not mean that 1951 is come again ; quite a moderate damping down of home demand should suffice to right the position. If it is true that our troubles are only marginal, however, it is also fair to suggest that we might have been better off without part at least of the marginal £560 millions of bank deposits created during the past three years.

In these days, of course, any suggestion that the size of the money stock may have an important connection with inflationary tendencies is liable to be dismissed as old-fashioned prejudice. One reviewer of the valuable study by Mr. A. J. Brown, *The Great Inflation, 1939–1951*,[1] for example, loftily complains that the author " rejects any attempt to analyse the process of inflation merely in terms of the pressure of demand upon inadequate supplies or stocks, and makes extensive use of such trusted (and rusted ?) old tools as the quantity of money in

[1] Oxford University Press, price 30s.

different countries at different times." A great deal of undergraduate instruction is devoted to explaining the flaws in the quantity theory of money. Logically, no doubt, the connection between the size of the money stock and the level of prices or money incomes is a highly flexible one, liable to be upset by any number of variables, from short-period changes in the level of business confidence to long-period changes in the degree of vertical integration of industry. Intellectually, this is very important. For practical purposes, it is just as important to remember that the significant thing about the variables under normal conditions is their remarkable stability: monetary habits do not fluctuate wildly without strong reason.

In a free economy following an even course, one of the most stable relationships in the whole field of economics is usually that between the supply of money and the total of money incomes. In 1941, for example, Professor Pigou pointed out[1] that " the money income per annum of this country has for some time stood at about twice the amount of the money stock . . . money income for six months and money stock are equal." So impressed was he by this stability as to suggest that it even afforded some warrant " for treating variations in deposits as a reasonably good index of variations in income " ; in other words, that one would not go far wrong by assuming the income velocity of bank deposits to be always 2.

In point of fact, income velocity is not quite so stable as that, and Professor Pigou failed to allow in his argument for the fact that deposits are always higher in the second half of the calendar year. Moreover, he was unfortunate in proposing this method of forecasting the national income at the precise moment when the relationship normal in a free economy was being disrupted by physical controls over spending, controls which enabled the authorities to create deposits without generating a corresponding increase in money incomes. No sooner had Professor Pigou stressed the normal stability of income velocity, in other words, than income velocity was driven down to ever more artificially low levels by the techniques of war economy.

Fundamentally, of course, Professor Pigou was right. The people of this country do not, if they are free to spend their own money, hold cash balances equivalent to nine months' income, as they were compelled to do in 1946. An income velocity of 1·33, in other words, is abnormally low and it was

[1] *Economic Journal*, December, 1941, " Types of War Inflation."

inevitable that as physical controls were relaxed the rate of turnover of bank deposits should rise again to more normal levels. Income velocity can be depressed by direct restraints upon spending; it may fall spontaneously during a *crise de confiance* or soar to unusual heights at the top of a boom; but it is a fairly safe proposition that in a free economy the creation of £500 millions of bank deposits will sooner or later add something like £1,000 millions to the national income in money terms. If the supply of goods and services also rises by £1,000 millions, either because there was slack in the economy or because productivity is rising fast, the price level will remain stable (though even this is no guarantee that the balance of payments will also be unaffected). If the supply of goods and services does not expand correspondingly, then part of the eventual increase of £1,000 millions or so in money incomes will have its counterpart in higher prices.

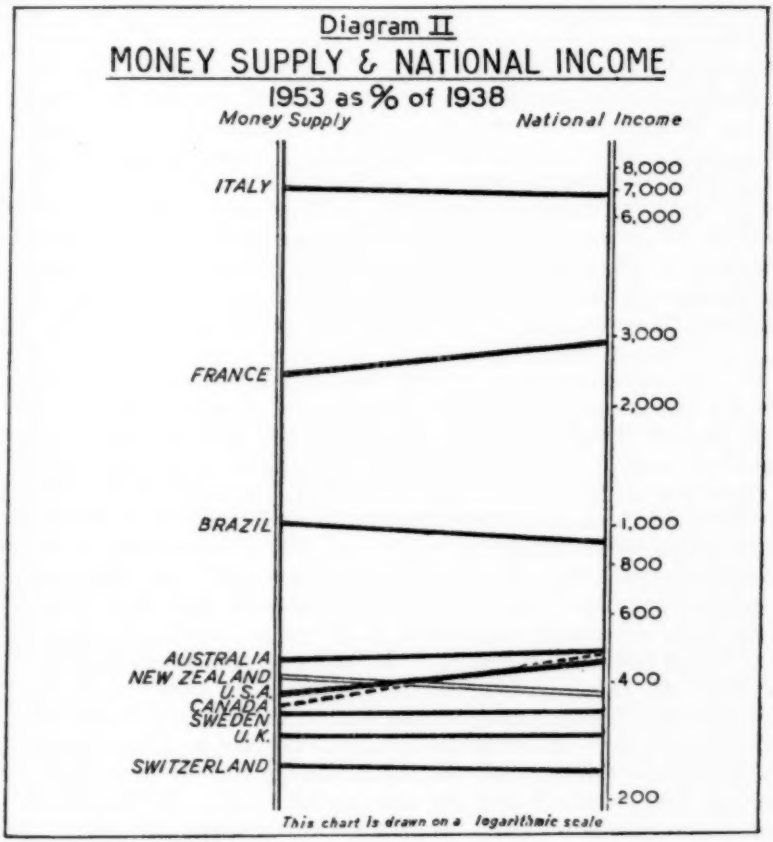
The remarkable stability of income velocity, when this is determined by the unfettered action of the public and conditions are reasonably normal, is brought out by a comparison of the changes in money supply and national income in this and other countries between 1938 and 1953. By the latter year, the war-time accumulations of demand had been largely worked off and physical controls had almost disappeared. Over an interval of fifteen years which included the upheaval of a world war, it would not be surprising to find quite substantial changes in monetary habits (though one might expect income velocities, if changed at all, to have risen rather than fallen, since there is no *prima facie* reason why fifteen years of currency depreciation should induce people to hold relatively more of their savings in monetary form). In reality, the correspondence between the growth of money supply[1] and of national income is uncannily close. In Switzerland, both were about two and a half times the pre-war figure; in this country both had slightly less than trebled, and so on. Even in the extreme case, among the countries selected, of Italy we find that a money supply in 1953 about 71 times as great as before the war was associated with a national income 68½ times as great. When the two magnitudes are plotted on parallel scales, as in Diagram II, it will be

[1] Money supply is taken as including deposit accounts, as the effect of excluding them over this period is in some cases to give a distorted picture.

seen that the lines joining them form a ladder of which most of the rungs are almost exactly horizontal. Where the lines slope perceptibly there is often a self-evident explanation: the contrast between the relative stagnation of pre-war days and the peak of the post-war boom in North America, for instance, clearly accounts for the increase in income velocity in the United States and Canada.

* * *

After the experience of recent years there should be no mistaking the symptoms of a dangerously high level of home demand and many of these were becoming apparent in the latter half of 1954: the lengthening of delivery dates, the



excess of unfilled vacancies over the number of unemployed, the stagnation of exports coupled with the rising trend of imports—all side by side with the resumed uptrend of retail prices and a quickening of the wages spiral. Against this background the buoyancy of the gilt-edged market was particularly significant. Compared with the 1946 cheap money boom, the actual rise in prices may not have been dramatic; the fact that gilt-edged prices should rise at all in an economy strained to the limit was quite remarkable.

This is the clearest pointer of all towards an abundant money supply. If it were true that the supply of money had been no more than keeping pace with the expansion in turnover, then gilt-edged would have remained no better than stable. In reality, the market was signalling that, in spite of the growth in the money turnovers to be financed (a growth due as much to rising costs as to rising output), the public was feeling not less liquid but more liquid than before. Or to put the same point in different words, the level of confidence was so high that funds could be tempted out of the investment circulation to meet the growing demands of the active circulation by the offer of falling rates of interest instead of the rising rates that would be more usual at a time of high activity. If it were desired to place a brake upon rising monetary values, either a decline in confidence or a contraction in the supply of money, or some combination of the two, would be needed.

To appreciate how curious has been the recent behaviour of the gilt-edged market, it is necessary to remind ourselves of the factors which normally determine the level of long-term interest rates. Mr. A. J. Brown devotes a most interesting chapter to this subject in *The Great Inflation 1939–1951*. This was, as he says, the only major price movement " in history which has been accompanied by an interest-movement in the opposite direction." Yet, as he also points out, " the clear and obvious empirical relation in most countries and most times has been a positive correlation between the level of interest rates and the level of prices." In other words, in all previous periods of rising prices, interest rates have also risen, and conversely. On general grounds it is, of course, to be expected that both prices and interest rates should rise together during a boom and fall together during a slump, but the correlation up to 1939 was always far closer than could be explained on those grounds alone. It is the extraordinary closeness of

the correlation which constitutes the famous Gibson Paradox that attracted the attention of Keynes and others.

According to the Gibson Paradox, then, the fact that interest rates should decline in wartime was itself a paradox. The conflict surely arises only from the particular way in which the Gibson Paradox was formulated. It was derived from the observation of price and interest movements under nineteenth century conditions. But in a free economy a period of rising prices will also be a period of rising income velocities; and it is the rise in income velocity—an increasing strain on the existing money supply—that tends to depress gilt-edged, not rising prices as such. It seems reasonable to suppose that if the Gibson Paradox had been expressed in terms of a positive correlation between income velocities and gilt-edged yields, instead of a correlation between prices and gilt-edged yields, then it would also have served to explain the movements during the war, when prices rose but income velocity and gilt-edged yields declined.

The closeness of this relationship, not always year by year but over a period, is brought out in Diagram III, which compares since 1924 the trend of Consols *prices* (not yields) with the inverse of income velocity: namely, the size of the money supply expressed as a percentage of the national income. It will be seen that, though the turning points in the trend of money supply and of Consols prices do not always coincide, the period can be divided into a few major phases in which the behaviour of the two series is broadly similar.

From 1924 to 1929 there was little movement in either. From 1930 to 1933 the money supply was rising (income velocity falling), at first because of the depression and later because of the deliberate expansion of credit in connection with the War Loan conversion of 1932, which saw the beginning of the period of cheap money based on a 2 per cent. Bank Rate that lasted (except for a flicker in the opening weeks of the war) until November, 1951. Gilt-edged prices (as was to be expected in view of the shock to confidence resulting from the external crisis that took us off the gold standard in 1931) did not turn upwards until 1932 but they continued rising until 1935, although credit expansion did not keep pace with industrial recovery after 1933. From 1935 to 1939 income velocity rose and gilt-edged prices sagged, the decline being accentuated in the later years of this period by the fears arising from the

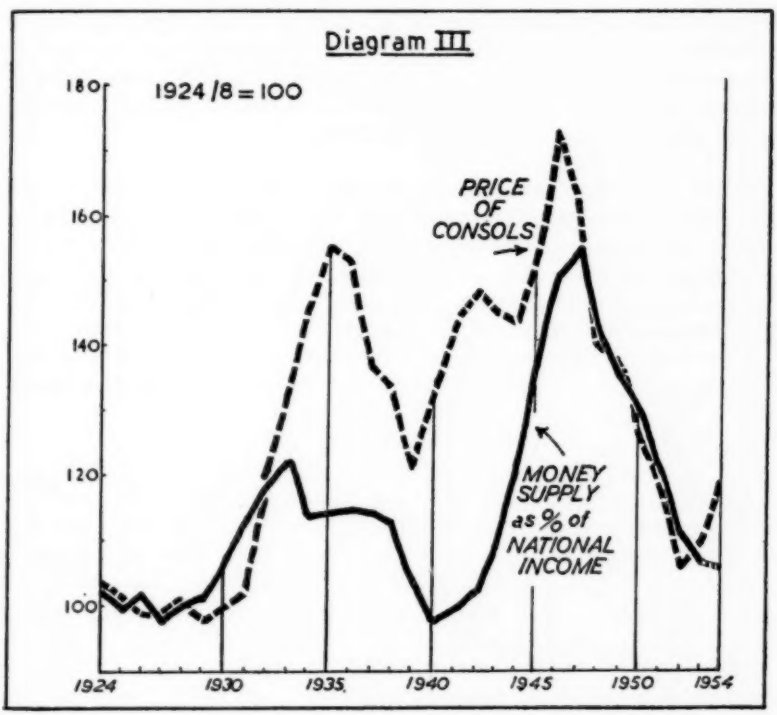
imminence of war. From 1942 to 1947 we have the great increase in liquidity arising from the combination of deficit finance with physical controls, and topped up by the misguided cheap money drive of 1946. Gilt-edged responded by rising to peak levels in 1946 but the market actually broke before income velocity began to rise again with the relaxation of physical controls. Thereafter, the two lines move in close and predictable harmony until 1952. Since then, there has been an equally marked divergence, the recovery in gilt-edged being associated with a continued increase in the rate of turnover of the stock of money.

It is evident from this brief survey that income velocity alone will not provide a complete explanation of the behaviour of gilt-edged. To suggest otherwise would be to imply that in this market, unlike every other, only the supply side counted. In reality, in some years it is not the supply of liquid assets, as we have already seen, but changes in the demand for them—violent swings in the level of business confidence—that have dominated the movement of prices, and it may be necessary to take still other factors into account. Mr. Brown mentions two which, taken in conjunction with changes in income velocity, go far towards accounting for actual changes in the long-term rate of interest as reflected in the prices of fixed-interest securities.

The first is the rate of dividends being earned [distributed?] on ordinary shares: "When this is high, there will be a tendency to sell bonds in order to buy these shares, which will pull up the bond yield even though there has been no change in the ratio of idle money to liquid assets." The second factor to which appeal may be made is the state of expectations concerning bond prices: "It is reasonable to suppose that, when bond prices have been rising, confidence in their continuing to do so, or at least in their not falling, will . . . raise the price above what, in the existing state of supply of liquid assets and idle money, it would otherwise be, and this possible explanation clearly fits the facts quite well." Those movements in interest rates which cannot be explained by changes in income velocity, in other words, seem to be closely connected, not only with changes in equity dividends, but also with the trend of Consols prices over the preceding three years. There is, of course, no need to choose between the two factors: "A high level of equity dividends

is very closely associated with a bond price which has been falling for obvious reasons."

The rise in gilt-edged prices last year is clearly very difficult to reconcile with this analysis. Obviously, the initial upturn in 1953 was a perfectly normal reflection of the upsurge in confidence inspired by the surmounting of the national crisis. What is less easily explained is the further advance during 1954 : a year in which income velocity was already high and probably rising rather than falling, in which equity dividends were soaring, the industrial market booming and capital plans to cost hundreds of millions being announced by one industry or another almost every week. In the circumstances there is nothing surprising in the fact that gilt-edged had already passed their peak some time before the first rise in Bank Rate to 3½ per cent. On the contrary, it is the recovery in prices during the days which followed the second step to 4½ per cent. that may seem the more noteworthy.



No doubt, that relative firmness indicated in the main a belief that our balance of payments troubles would all be over in a matter of weeks. Even if that proved correct, it would not necessarily mean a return to conditions favouring buoyancy of the gilt-edged market. The present adjustment, however modest, will not be complete until there has been some reduction in the aggregate flow of spending; for balance to be restored, some of the marginal demands on our over-burdened economy have to be squeezed out and in that process the long-term rate of interest is obviously involved. Even a reduction in Bank Rate and short-term rates in general would not automatically bring about a recovery in gilt-edged if it is assumed that the authorities will succeed both in maintaining a high level of industrial activity and in bearing down firmly upon the supply of money. Perhaps after all the behaviour of the market should in fact be construed not as a vote of confidence in the outlook for sterling but rather as a vote of no confidence that the tighter monetary policy will be carried through to its logical conclusion? There seems no reason to doubt that a vigorous use of Bank Rate is as capable under modern as under classical conditions of righting the balance of payments and preserving the internal purchasing power of the currency. The only question is whether, under modern conditions, it will be allowed to do so.

The real argument, in other words, is not concerned with the efficacy of a particular technique but with ultimate policies. It is concerned with the balance of political forces and the question whether other objectives will not in the end take precedence, in future as for many years past, over that of maintaining the value of the pound.

W. M. D.

How Subsidies Distort Housing Development

By F. J. Osborn

FOR the most part, discussion of the housing subsidies has been concerned with their general level. Far too little has been heard of another aspect of the problem which is the particular concern of this article: namely, the effect of the present subsidy scales in distorting the whole direction of building development. There can be no doubt, as will be shown, that the existing system not only penalizes the building of houses compared with the building of flats but also helps to perpetuate urban over-concentration and its attendant evils by encouraging the building of flats on expensive sites in large cities.

So far as the general level of the subsidies is concerned, the logic of the case points to a general scaling down, whichever party may be in power. The political difficulties are obvious. Yet all the reasons for subsidization—the desire to raise living standards, the need to prevent excessive increases in rent due to war-time housing shortages, the belief that high building costs are only temporary—are now of diminishing validity. There seems no doubt that there must be, over a period, a gradual adjustment of rents to the greatly increased level of money incomes, and a gradual over-all reduction in the subsidies. What is vitally necessary is that in these coming revisions more attention be paid than in the past to the structure or graduation of the subsidy system, with its powerful effects on housing standards and the character of urban development.

SUBSIDIES AFTER TWO WARS

For our purpose it is not necessary to take note of the details of the various subsidy schemes since their inception in the 1919 (Addison) Act but only of the more important points of principle which are involved. Under the Addison Act, an absolute ceiling was placed on the liability of the local authorities equivalent to the proceeds of a penny rate. The State thus assumed the whole of any additional liability arising if local costs were above the average or the local authorities' programmes particularly ambitious. Local councils had no financial interest

in the cost of their housing schemes and a cumbrous central control was necessitated.

Had that system been continued, it would obviously have had the effect of a national subsidy differentiating in favour of the most expensive situations. It was in fact succeeded by the flat-rate (Chamberlain) subsidy of an equal amount for all situations, available also to private enterprise, no local authority contribution being required. The 1924 (Wheatley) Act introduced a subsidy at a higher rate and of longer duration, varying as between urban areas and rural parishes, as well as a local authority contribution of 50 per cent. of the State subsidy.

Under the Greenwood Slum Clearance Act of 1930 a new principle was introduced in the form of variation of the subsidy according to the number of persons housed. It was in this Act that the differential subsidy for flats, which has since grown to such gargantuan dimensions, first made a modest appearance. An additional subsidy was granted where the land cost more than £3,000 per acre, with no corresponding contribution from the local authority. This principle of graduation in favour of flats on expensive sites was extended under the Housing Acts of 1935 and 1936, the main purpose of which was to abate overcrowding, and under them the local authority had to add 50 per cent. to the State's additional contributions. In the 1938 Act the subsidy for flats on expensive sites was continued as before, but with a maximum for land at £30,000 an acre.

This pre-war differentiation between urban and rural housing, and between normal two or three storey houses and flats on expensive sites, has been continued and amplified in the post-war subsidies. In addition, a further differentiation has been introduced to meet the cost of lifts in high blocks of flats. Under the 1946 (Bevan) Act, the capitalized value[1] of the subsidy for a normal urban house was £593; that for a flat in a block with lifts, on land costing £10,000–£12,000 an acre, was as much as £1,550—an excess subsidy of £957 in favour of the flat.

This was remarkable enough, but in the 1952 (Macmillan) Act not only were the subsidies increased but the differentiation was widened. At the prevailing interest rate of 4¼ per cent., the capitalized value of the subsidy on the type of flat in question became £2,093, or no less than £1,324 more than the £769

[1] The capitalized value of the subsidy represents the *present* value of the total payments to be made, future payments being discounted at an appropriate rate of interest. The capitalized value is therefore smaller than the sum of the actual sums to be paid out. For example, if the subsidy is £86 15s. for 60 years the State will make payments totalling £5,205, but the capitalized value of the subsidy at 3¾ per cent. is only £2,059.

granted for a normal house. When in 1954 the rate of interest declined to 3¾ per cent.,[1] the capital value of the flat subsidy was automatically raised to £2,301 and the "premium" to £1,456. The position was not basically changed by the revised scales announced last June to apply to dwellings completed after April 1st, 1955. The capitalized value of the "lift-flat" subsidy falls to £2,059 but this still represents an excess of £1,361 over the house subsidy. The tables below and overleaf set out the changes since 1946 in the subsidies for England and Wales and their capitalized value.

It is worth noting that in Scotland there is no expressed scale for varying land costs, while on the other hand there is an intelligent differential for sizes of dwellings. None the less, the gap between the subsidies for flats and houses respectively is still very great, though less than in England and Wales.

The employment of capitalized values for purposes of comparing subsidies for different classes and situations of dwellings may at first seem questionable. It is in my view the most useful yardstick, because it equates the relative financial burden for the differing periods over which the subsidies extend

[1] On February 28th last the rate was increased to 4 per cent. While this somewhat reduces the capitalized values of subsidies it does not in any way affect the underlying argument of this article.

Annual Subsidy

(Combined Annual Contributions, Exchequer and Local Authority)

	Housing Act 1946	Housing Act 1952	
		Originally	As from 1st April, 1955
	£ s. d.	£ s. d.	£ s. d.
General Standard	22 0 0	35 12 0	29 8 0
Special (Agricultural)	28 10 0	40 14 0	36 1 0
Flat (Expensive Site without Lift)—			
£1,500– £4,000 per acre ..	38 0 0	70 8 0	61 4 0
£10,000–£12,000 „ „ ..	47 0 0	81 4 0	71 0 0
£28,000–£30,000 „ „ ..	65 0 0	104 12 0	92 12 0
Flat (Expensive Site with Lift)—			
£1,500– £4,000 per acre ..	48 10 0	86 3 0	76 19 0
£10,000–£12,000 „ „ ..	57 10 0	96 19 0	86 15 0
£28,000–£30,000 „ „ ..	75 10 0	120 7 0	108 7 0

and for the varying rates of interest on loans. It is also, in the main, the measure of the unremunerative capital expenditure incurred at the time of building. The only qualification to this is that some part of the " lift-flat " subsidy is designed to cover the cost of running the lifts and the higher maintenance and management expenses of flats, which on council estates may together be of the order of £10 to £15 a year. Even so, the differences in capitalized values reflect pretty exactly the differences in the public burden involved. And, except for the fraction attributable to these annual running expenses, the excess amount of the flat subsidy corresponds closely to the extra capital cost, in constructional materials and labour, expended out of national resources at the moment of building. Thus, when the rate of interest fell by ½ per cent. between 1952 and 1954, raising the capitalized value of the English subsidy from £2,093 to £2,301, an additional sum of £208 a

Capital Value

(Capitalized Value of 60 years' Subsidies)

	Housing Act 1946. Capital value at 3½%	Housing Act 1952. Capital value at:			As from 1st April, 1955. Capital value at 3½% *
		4½%	4%	3½%	
	£	£	£	£	£
General Standard	593	769	805	845	698
Special (Agricultural) ..	768	879	921	966	856
Flat (Expensive Site without Lift)—					
£1,500– £4,000 per acre	1,024	1,520	1,593	1,671	1,453
£10,000–£12,000 „ „	1,267	1,753	1,837	1,928	1,685
£28,000–£30,000 „ „	1,752	2,259	2,366	2,483	2,198
Flat (Expensive Site with Lift)—					
£1,500– £4,000 per acre	1,307	1,860	1,949	2,045	1,827
£10,000–£12,000 „ „	1,550	2,093	2,193	2,301	2,059
£28,000–£30,000 „ „	2,035	2,599	2,723	2,857	2,572

* As from February 28th the rate was altered to 4 per cent. and if this remains in force after April 1st the figures in this column will, of course, be modified to some extent. The ratios between houses and flats will, however, remain the same.

flat became available to be spent on bricks and mortar without increase of rent. In other words, a greater capital loss could be incurred, even though the annual loan charges remained static and were still covered by the annual subsidy.

HOUSES v. FLATS

In comparing the cost of sites for houses with those for flats on expensive land, it is necessary to allow for the differences in building densities. If the price of the land does not exceed £10,000 an acre, and forty flats are placed on an acre, the cost of land and site development for each of these dwellings will be no greater than that for houses built at twelve or fifteen to the acre on land at £3,000–£3,750 an acre. Indeed, if the flats are built at sixty to the acre, the same comparison will hold true for sites costing as much as £15,000 an acre.

It is thus quite a delusion to believe that expensive site values are important in the justification of the flats subsidies. That justification, if it can be so named, is to be found almost wholly in the higher *building* cost of flats as against houses. A typical three-bedroom house of say 950 sq. ft. costs, in a suburb or country town in the south of England, about £1,500. Some of the " lift-flats " of 750 sq. ft. now being built in London and other great cities are costing more than £3,000, and few cost less than £2,500. When the 1955 subsidy scale is analysed, and deductions made for site costs at varying land values, it is found that the subsidy for a " lift-flat " at £11,000 an acre allows about £1,250–£1,350 extra to cover building costs compared with that for a normal house. The actual difference between these two subsidies is £1,361. Allowing say £10 10s. a year (capital value £250) for the higher running cost of the flat, the subsidy permits of its building cost being about £1,000–£1,100 more than that of a house, assuming the net rent charged is the same. Commonly, the rents of lift-flats are a little above those of houses, often because the excess building cost of the flat is more than £1,100 or the excess maintenance more than £10 10s. a year. Yet the flat usually has a considerably smaller useable floor-space than the house.

These figures, which are representative (although there are wide divergences, both up and down), put the facts in perspective. They enable one to understand why municipal corporations insist on such enormous subsidies for flats, and why successive ministers have agreed to them. They explode completely any idea that " building up " is now, as it was in the past, rendered economical by the high cost of city land. The

relative insignificance of site cost in the total equation is brought out in Diagram I. This shows, for six representative examples (two houses and four flats) the relationship between the capitalized value of subsidies on the one hand, and building and site cost on the other hand. Even in the case of the two-bedroomed flat on land at £11,000 per acre, the site cost (assuming a density of 35 to the acre) is only £314, compared with £200 for the houses. This represents 11 per cent. of the total cost, whereas the subsidy covers 73 per cent. of the total cost. In the case of the flat on land costing £29,000 an acre the site cost rises to £829, but even this is only one-quarter of the total cost, of which the subsidy covers more than three-quarters. At £60,000 an acre (of which there have been examples in Holborn and Finsbury) the capitalized subsidy on the 1955 scale would, at the standard density of 35 to the acre, be £3,426 a flat. In practice, the density on such land would probably be 60 to the acre, reducing the site cost to £1,000 and the subsidy to a little over £2,700, or nearly three times the site cost. This is four times the subsidy given on a normal house and equivalent to nearly twice the building cost of such a house.

Diagram II shows the economic rent of typical houses and flats, and brings out the effect of the differential subsidies in roughly equating rents. It will be noted that for the houses the subsidy represents about one-third of the economic rent, for the flats anything from about 60 per cent. to more than three-quarters. The Flat A example illustrates another anomaly in the subsidy scale : that it takes no account of the different sizes

Data on which Diagrams are Based

	Houses		Flats			
	A	B	A	B	C	D
No. of bedrooms ..	2	3	1	2	2	2
No. of persons	4	5	2	4	4	4
Floor area, sq. feet ..	800	950	500	750	750	750
Building cost	£1,440	£1,550	£1,750	£2,500	£2,500	£2,500
Site cost per acre* ..	£3,000	£3,000	£11,000	£7,000	£11,000	£29,000
Density per acre ..	15	15	35	35	35	35
Subsidy (capitalized) ..	£698	£698	£2,059	£1,945	£2,059	£2,572

* Including development costs (roads and services).

Diagram I

BUILDING & SITE COSTS COMPARED WITH CAPITALISED VALUE OF SUBSIDIES

Two Storey Houses; Multi-Storey Flats With Lifts

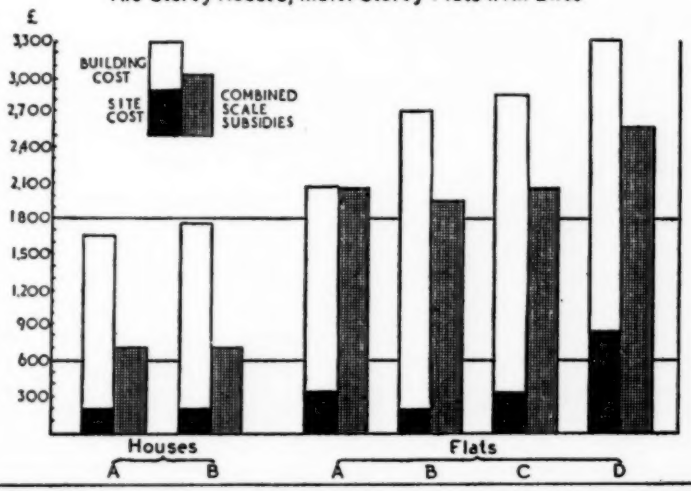


Diagram II

RENTS COMPARED WITH ANNUAL SUBSIDIES

Two Storey Houses; Multi-Storey Flats With Lifts

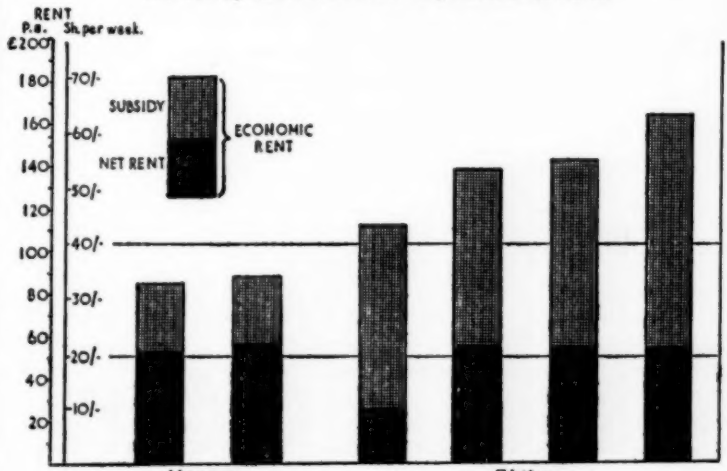


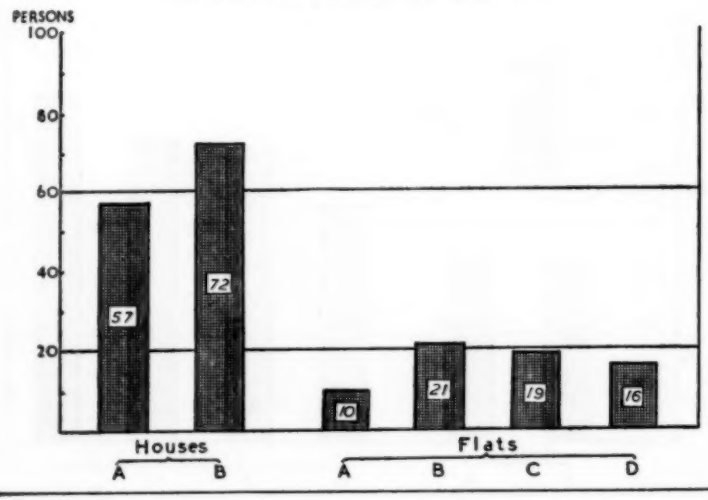
Diagram III

FLOOR SPACE PROVIDED PER £100 OF CAPITALISED SUBSIDIES

Diagram IV

NUMBER OF PERSONS HOUSED

By £10,000 of Capitalised Subsidies



of dwellings. The result is that an authority, by including a proportion of very small units, can lower its average rents all round. On a very small flat for one or two persons the subsidy can amount almost to the total economic rent—and though the Ministry would not be likely to encourage thoroughgoing use of this expedient, it is employed to some extent.

This failure to relate the amount of the subsidy to the size of the dwelling applies over the whole scale, and must be a potent factor in inducing authorities to reduce the average number of rooms and the area of floor space per dwelling. In Northern Ireland, as well as in Scotland, the subsidy is varied with the number of rooms, and in many other countries it bears a definite relationship to the floor-space provided. The extraordinary discrepancies between the amounts of useful house-room procured in different types of dwelling per £100 of capital subsidy expended is shown in Diagram III. As will be seen, it varies for the types shown (which do not reach the extremes) from 24 to 136 sq. ft. It is true that this system incidentally permits of the provision of small dwellings for old persons at specially low rents, which has a popular appeal. But there could be other and better ways of making that provision. The present method is regressive to an inordinate degree. It tends against the original purpose of housing subsidies : that of grading-up inadequate standards of housing.

Diagram IV illustrates the regressiveness of the scales in another way, and also emphasizes the meagre results obtained, in some cases, at colossal cost. Few at present realize that we are, in certain schemes, sinking £10,000 without return for the purpose of housing as few as nineteen, or in a possible case as few as ten, persons, whereas in a different and usually more acceptable type of dwelling we can house for that money 72 persons or more.

These comparisons are of more than academic importance, because there is at present an influential campaign, supported by æsthetic fashion and inspired by the desire to economize agricultural land and to preserve countryside amenities, to "build upwards." Coupled with this is a widespread belief that building upwards is necessitated by high urban land costs and that it is economical—a belief that cannot stand up to the facts. The idea that building upwards is necessary to avoid a catastrophic loss of farm land and of home food production is doubly fallacious. First, the area of land that could be saved by flat-building on the most intensive scale imaginable is

insignificant; I estimate it at less than one-fifth of one per cent. of Britain's agricultural land over the next 20 years. On the other hand, the extra cost in housing subsidies would be fabulous. For each 1,000 flats built at 60 to an acre in place of 1,000 houses at 15 to an acre, 50 acres less would be used; but the subsidies (on land at £11,000 an acre) would cost £1¼ millions more—that is, £25,000 more for each acre of land "saved." That sum, spent on farm improvement or reclamation, would replace many times the produce of the lost acres.

Second, the value of food from the gardens of a low-density housing estate will on average exceed that from the farm land on which the estate is built. Figures recently released by the Ministry of Housing and Local Government show that in 1952 the annual value of food from gardens (good and bad together) at 12 houses an acre averaged £67 12s. an acre, whereas that from medium-quality farm land was about £44 an acre.[1] (The garden produce is at retail prices and the farm produce at farm-gate prices; but this is a fair comparison, since on the former distribution costs are saved.) A survey made by the Ministries of Agriculture and Housing in 1953 shows that even more food is grown on an average per acre at housing densities of 8 and 10 than at 12 or 15 an acre.[2] No food whatever is grown on the sites of flats at 60 an acre.

Taking the popular preference for houses and gardens and the value of garden produce in conjunction with considerations of cost, a re-examination of the whole policy is called for. A progressive adjustment of controlled rents and shaving down of subsidies, if roughly equal in measure for all situations and types of dwellings, would leave intact the differential between the cost of building and site in great cities and small towns, while enormously enlarging the percentage of total subsidies allotted to expensive buildings.

Local authorities, it is proposed, are to continue building at the rate of about 200,000 houses a year. In the last year or two the national bill for the combined subsidies has been mounting by about £10 millions a year, of which £6 or £7 millions is found by the State. At the minimum 1955 urban and rural subsidy, 200,000 houses annually will add nearly £7 millions a year to the bill. If 10 per cent. of these houses are on city sites

[1] *Manchester Guardian*, August 31*st*, 1953; figures confirmed in letter of January 28th, 1955, from Ministry of Housing to the author.

[2] *Town and Country Planning*, March, 1955: "Gardens and Food Production."

at an average of £8,000–£10,000 an acre, another £1 million of 60-year subsidies will be added, representing an additional (unremunerative) capital expenditure of £23,700,000 a year. All precedents indicate that the Treasury, which very rightly watches like a lynx many other capital and revenue expenditures, will automatically roll out any millions of capital that are covered by the current housing subsidy scale. It becomes essential, therefore, for those in authority to consider where this drive for building-up in the cities is leading us.

PROBLEM OF LARGE CITIES

Far-reaching implications are involved, of which our national advisers on public finance seem to take little account. It is an elementary economic observation that businesses and industries locate themselves in positions of the most advantage to themselves, subject to limitations imposed by law for public protection. They tend to re-locate themselves when a situation becomes unduly expensive or inconvenient; and we have seen in the last half-century a considerable spontaneous transfer of industry from costly and cramped sites in city centres to fringe districts and, more rarely, to smaller towns affording cheaper or more spacious sites. People occupied in industry and business find or place their homes in situations accessible to their places of work; hence (in the simplest terms) the great agglomerations of population, and the movements to and the vast expansions of suburbs as transport improves.

Unfortunately, this quest of private advantage creates, in all the great cities of the world, a welter of social and economic difficulties: central overcrowding, slums, shortage of recreation space and ever-growing traffic congestion. In all great cities it proves impossible for decaying dwellings to be replaced, traffic-ways improved or sufficient public open space provided either commercially or within the resources of local taxation. Cities being politically powerful, and national consciences only moderately tough, there is an irresistible call on governments to help in overcoming these difficulties. And this call, as the difficulties mount by reason of still further city growth, is more and more generously answered, as we have seen in studying the evolution of differential subsidies. Per head of population, the amount of money given by the State for rehousing in great cities is now vastly greater than that given for housing in small towns and villages, where it is usually a real addition to the national equipment and not a mere replacement. On the face of things,

we have drifted into a practice of encouraging financially, out of taxes collected from the whole nation, the maintenance of over-grown and over-concentrated urban fabrics and, in the case of large cities still growing, the continuance of a fundamentally uneconomic growth.

I suspect that a similar criticism could be made of other State grants-in-aid, many of which are on a percentage basis, and therefore involve larger than average payments per head of population to places where services and works of construction are more expensive. It might be argued, on the other hand, that city people, being richer, pay more than the average income tax or, dying sooner, pay more death duties, or that they drink more and smoke more. I am not equipped to go fully into this general issue, but I submit that it is deserving of study by experts in public finance. Criteria of fairness between districts usually seem related to " need " or " rate-burden," and to neglect the possible secondary effects of State grants or other expenditures on the distribution of population and industry.[1]

The same issue can be put in another way. Many industries and businesses are located in cities, where persons engaged in them have the choice of living fairly near in dwellings at high density or far away in suburbs reached by long journeys. To choose business locations in cities would be, I suggest, basically uneconomic unless their advantages were so great that the firms could pay their staffs enough to cover the rent of flats or daily travel, and could make their hours short enough to compensate for the time spent in travelling. If the firms could not afford such pay or hours there would be an incentive for them to move to more economic situations. Is it sound for the State, by subsidizing flats (or transport facilities), to lower the cost of living of employed people to the extent necessary to keep businesses in the cities? Clearly, in such a case, the State is either enabling the business to survive in a place from which it ought to move or, alternatively, is making a gift of extra profits to a business satisfactorily placed.

The question arises very practically in connection with the rebuilding of the City of London. Plans are announced for multi-storey office buildings capable of accommodating many thousands of additional workers, and concurrently for new tubes (which can hardly pay even if overloaded at peak hours),

[1] I raised this question in an article in the *Economic Journal* 36 years ago (" The Public Control of the Location of Towns " signed Edward Ormiston, December, 1918), but I do not think much work has been done on it.

for costly road tunnels, for road widenings and for blocks of flats. The office buildings, it may be presumed, will be commercially remunerative. But is not this made possible by the prospect that the State will find vast amounts of capital for road works, tubes and dwellings (which could not be commercially provided) and subsidies that pay the greater part of the loan charges on the housing capital?

OUTLINE OF A CONSTRUCTIVE POLICY

It is not within the scope of this article to discuss in detail what is the correct policy for a State confronted with claims for aid from wealthy cities that cannot replace their obsolete equipment out of their own reserves or revenues. These cities contain large populations and indispensable businesses, for which the State cannot abdicate its responsibility. Obviously, they cannot be lopped off as mouldered branches; but neither, in another metaphor, should they be assisted to flounder in a morass. National policy should surely be directed to rescuing the cities from their predicament, rather than to succouring them expensively where they are or pushing them further in. And in preferring rescue to succour the State could save millions in subsidies.

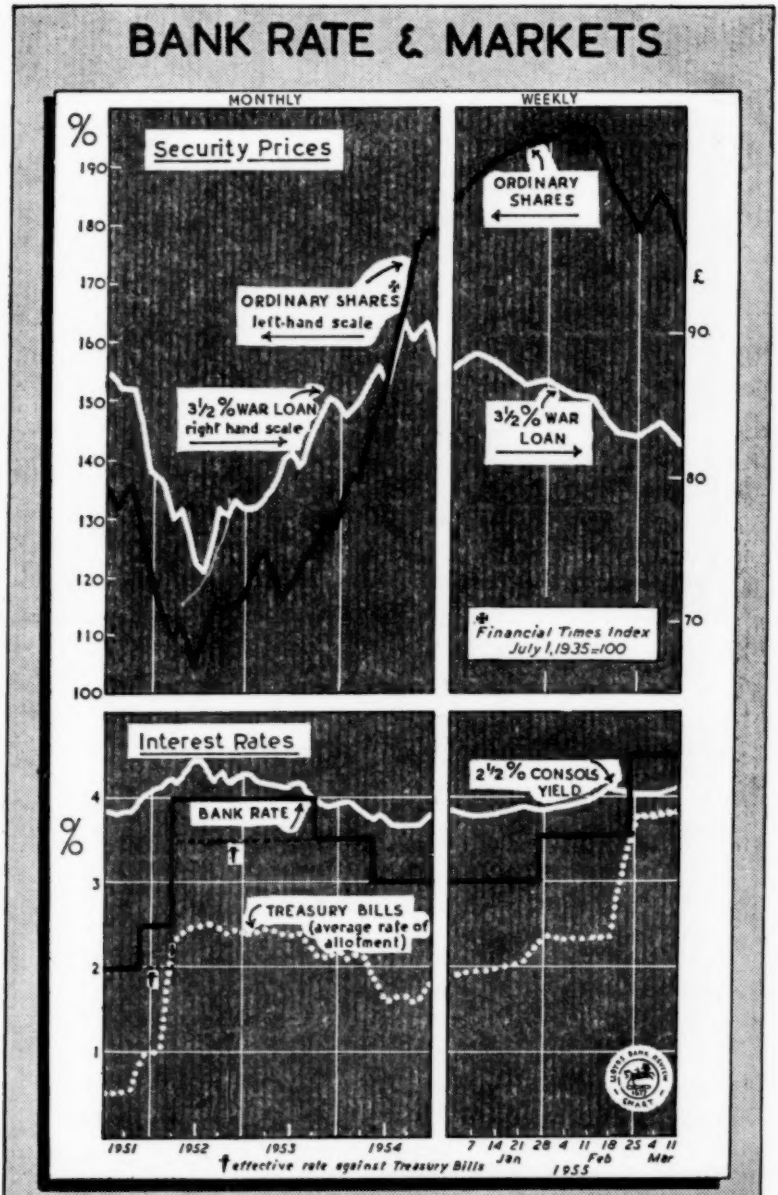
In London County and adjoining boroughs, for example, the present intention seems to be to couple a rather slow rate of dispersal to new towns and country towns with a continued building of flats at 40 to 60 an acre, at a rate of perhaps 5,000 to 10,000 flats a year. The speed of building does not affect the relative financial merits of higher or lower density. For the sake of argument let us assume that, to meet London's needs, 75,000 dwellings have to be built in the next ten to fifteen years. If all were flats at 40 to 60 an acre on land costing £10,000–£12,000 an acre, the capitalized value of the subsidies required from the State would be about £110 millions. Let us suppose that instead half the number were built on the same city sites at a density of 25 dwellings to the acre (permitting three-quarters to be houses and only one-quarter flats), and the other half in new towns or other country towns. The State, even after paying the local rate subsidy in the country towns, could save about £48 millions in housing subsidies and the local authorities £27 millions, while rents would be slightly less for better accommodation and more floor-space. There would, of course, be some offset to this saving in initial development costs for new towns and expansions elsewhere, but these would be small in comparison. Open spaces could be acquired in the

cities, compensation paid for factories and offices vacated, and still there would be a handsome margin of saving.

This saving is possible simply by administrative means within the present subsidy scale. But the scale itself is absurd —a constant temptation to wild extravagance at all levels of administration. Ideally, there should be, so long as housing subsidies are wanted, one all-areas grant varying with the floor-space provided. Obviously, however, big cities could not quickly digest the considerable rise of rents that this would mean, as against rents in small towns. Big cities should therefore, I suggest, receive special grants, but with the firm condition that a housing and redevelopment policy is pursued that will lessen business concentration and wasteful traffic movement, reduce housing density, increase playing-field space and generally enable the cities to progress towards a self-supporting state in which " rescue " grants will no longer be required. I do not think it would be practicable to follow logic so far as to detach altogether the subsidies for housing from grants for diminishing congestion. But either administratively, or in a revision of the scales for subsidies, we could at least avoid preferential State grants that have the effect of perpetuating urban congestion and of facilitating an undesirable growth of cities that would be prevented by spontaneous economic checks if it were not, as at present, subsidized by the State.

F. J. Osborn.

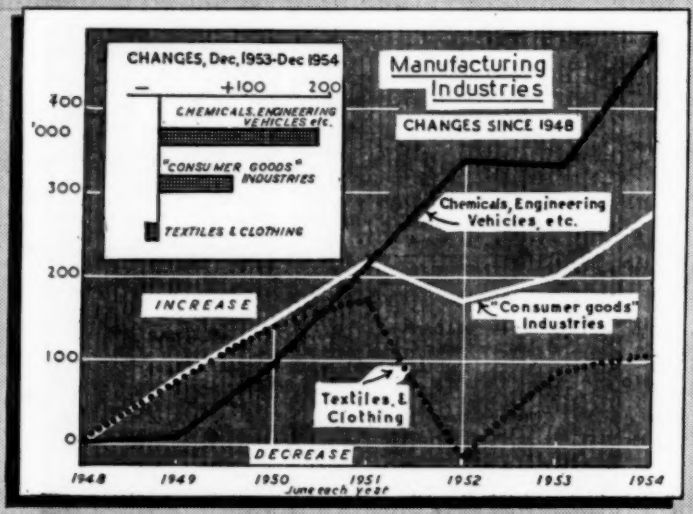
London.
February, 1955.

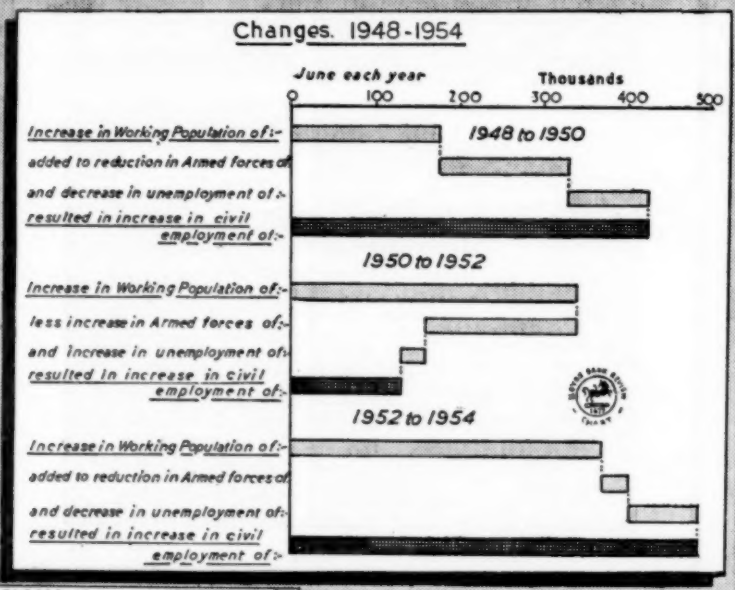


SOURCE : Financial Times

Following signs of weakness in sterling, Bank Rate has twice been raised this year, on the second occasion to 4½ per cent., the highest level since February, 1932. Towards the middle of March the *Financial Times* index of industrial ordinary shares was standing about 20 points below the peak touched on February 3rd.

MANPOWER

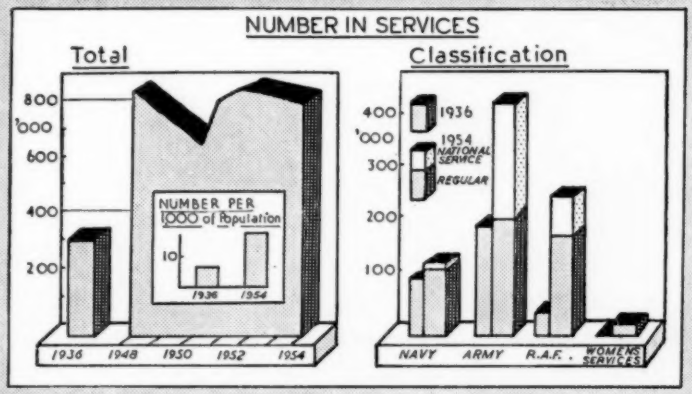


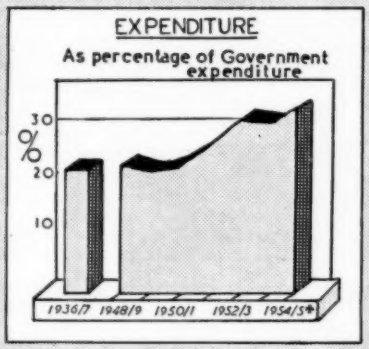


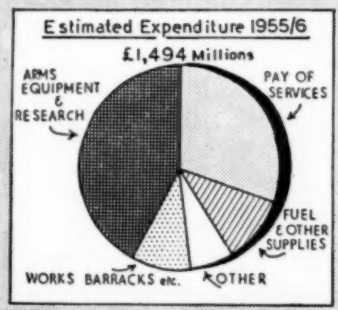
SOURCES: Ministry of Labour Gazette
Monthly Digest of Statistics

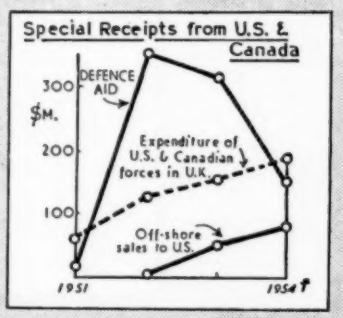
In the three years to last June, manpower in the chemicals, engineering and allied industries continued to expand, in contrast to the modest increase for "consumer goods" industries since 1951. In 1954 civil employment rose by 350,000, exceeding the growth in the working population, the remainder coming from the reduction in unemployment and in the forces.

DEFENCE







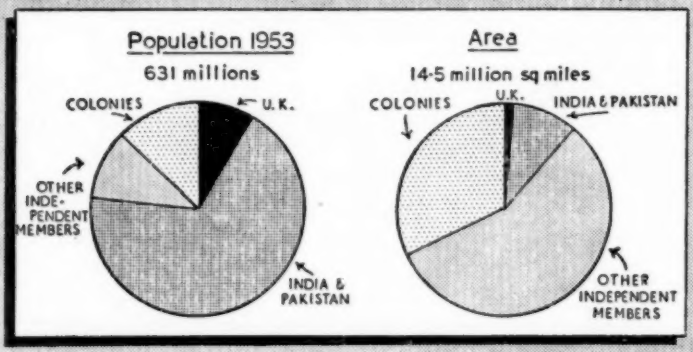


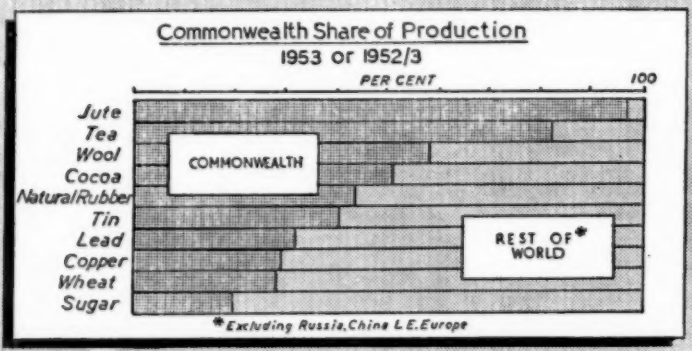
SOURCES: Defence White Papers
Financial Statements

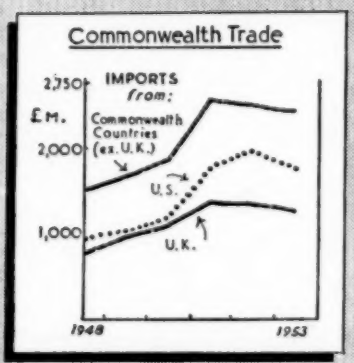
+Budget estimate †January at annual rate

The strength of the armed forces, including national servicemen, is now nearly two and a half times greater than pre-war, the R.A.F. in particular showing a marked expansion. Outlay on defence has accounted for about a third of government expenditure in recent years, against less than a quarter in 1936/7.

THE COMMONWEALTH



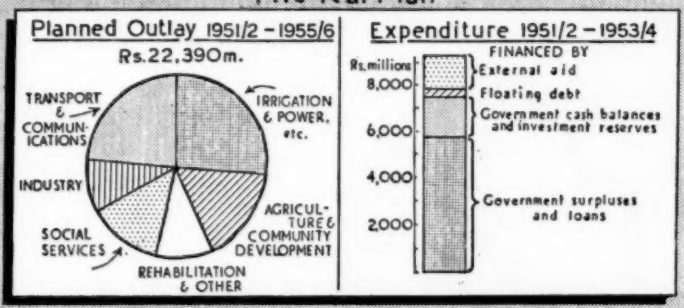


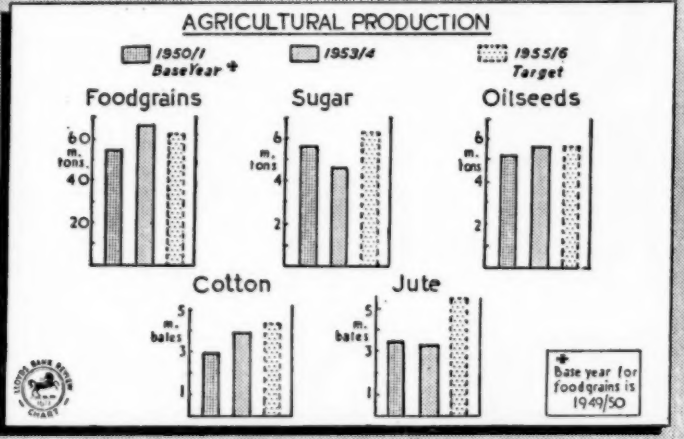


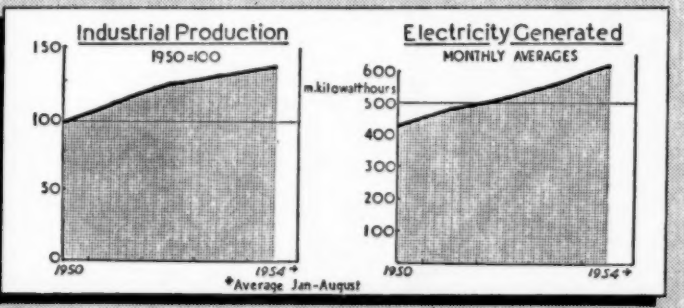
SOURCES: Commonwealth Statistical Abstract, 1955
Commonwealth Relations Office

India and Pakistan together account for nearly three-quarters of total Commonwealth population, while all the other independent overseas members, with over half the land area, have less than a tenth of the population. The middle diagram shows the rôle of the Commonwealth in the production of a number of important commodities and raw materials.

INDIA
Five Year Plan





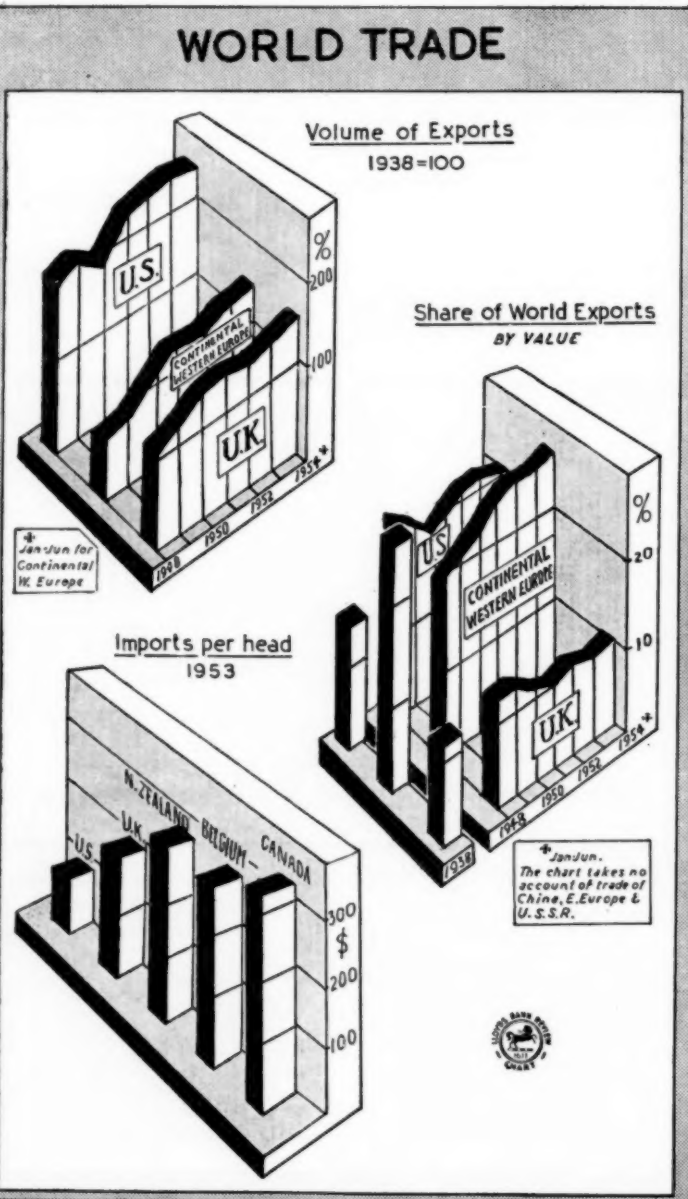


SOURCES: The Colombo Plan, 3rd Report, 1954. U.N. Bulletin of Statistics

Note: 1 million rupees is equal to £75,000

Of the outlay approximately equal to £1,680 millions planned for the five years to 1955/6, two-fifths had been spent by 1953/4. Government surpluses and loans financed nearly two-thirds of this expenditure. Production, both agricultural and industrial, has risen significantly in recent years.

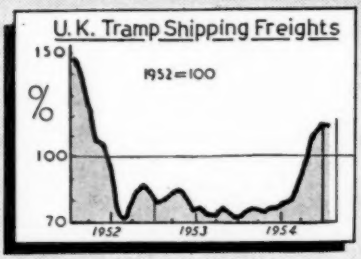
WORLD TRADE

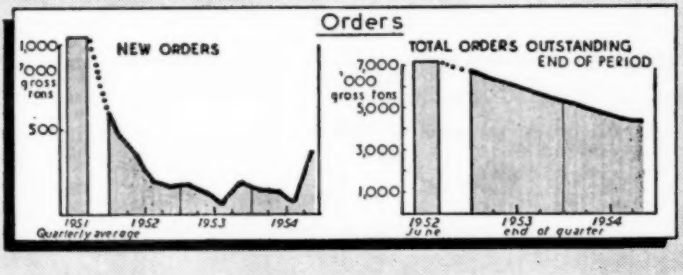


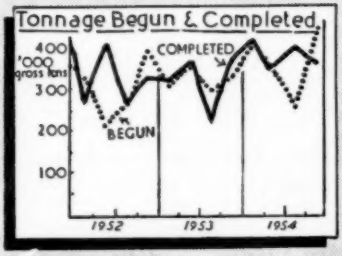
SOURCES: O.E.E.C., U.N., I.M.F. statistical bulletins

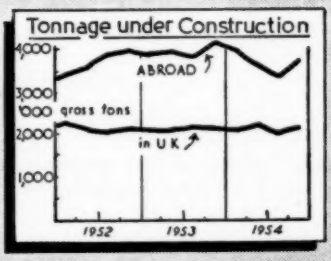
American exports, more than double their pre-war volume, now account for about a fifth of the world total. The U.K. share of world trade is slightly lower than in 1938 and the West European share, though rising, still somewhat below pre-war.

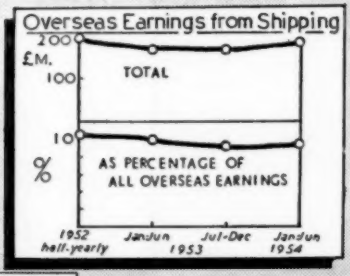
SHIPPING







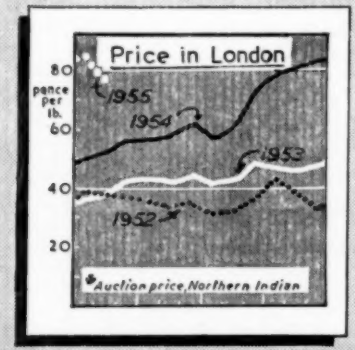


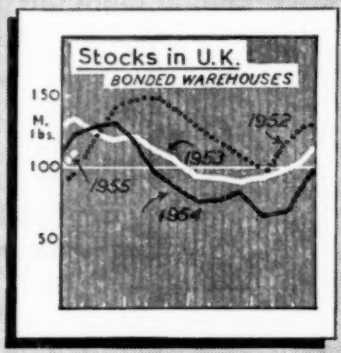


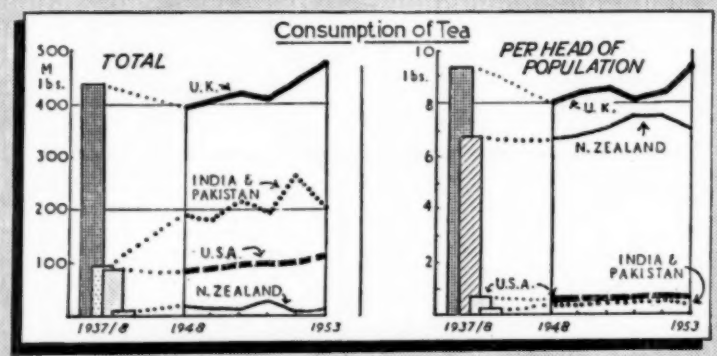
SOURCES: Shipbuilding Conference
Chamber of Shipping
Lloyd's Register of Shipping

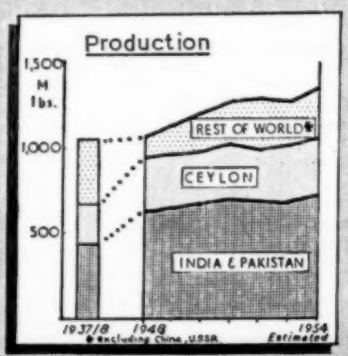
The output of U.K. shipyards last year was the best since the war, although new orders placed were at a relatively low level. It is significant that the sharp rise in freight rates towards the end of the year was accompanied by a large inflow of new orders, which may foreshadow an improvement in 1955.

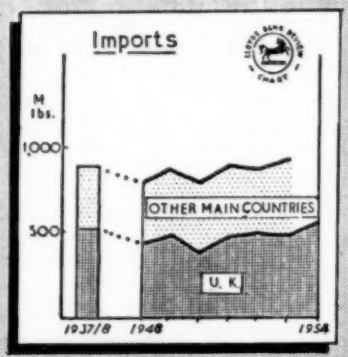
TEA







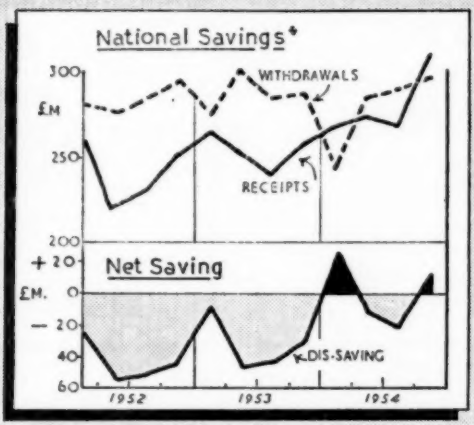


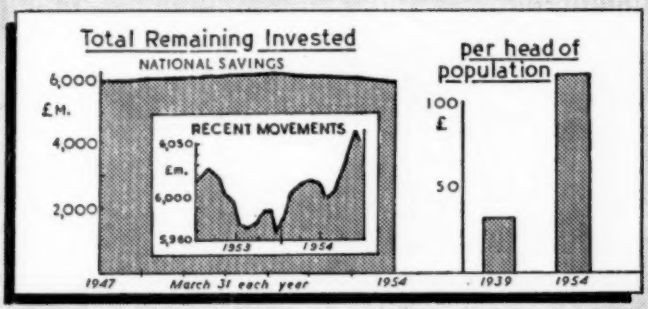


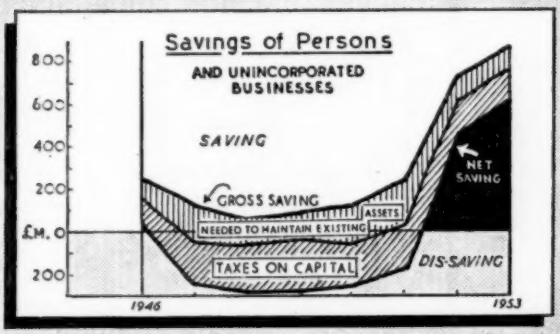
SOURCES: Commonwealth Economic Committee
Economist
Exchange Telegraph

The price of tea on the London market has fallen appreciably from the peak touched early in the year. The U.K. continues to take over half world imports of tea, consumption per head in 1953 being slightly above the pre-war level. Tea consumed in India and Pakistan, while considerable in total quantity, is still very small on a *per capita* basis.

PERSONAL SAVINGS





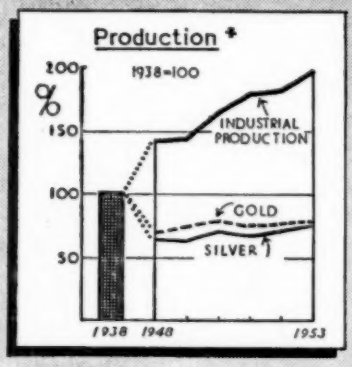


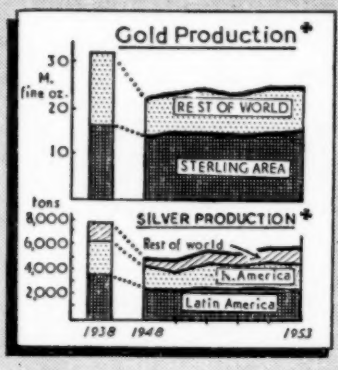
SOURCES: National Savings Committee
National Income Blue Book, 1954

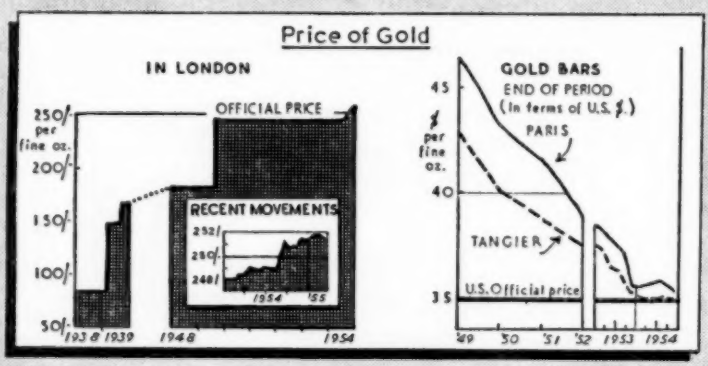
*National Savings figures include defence bonds redeemed at maturity

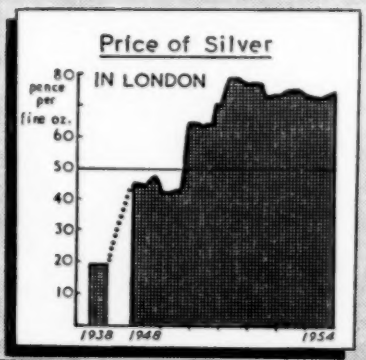
The last three years have seen a striking revival of personal saving, evidenced not only by the improvement in the national savings figures but also by the increase in the sums set aside out of income by private individuals and unincorporated businesses. The net total for the latter in 1953, for example, was over £600 millions.

GOLD & SILVER







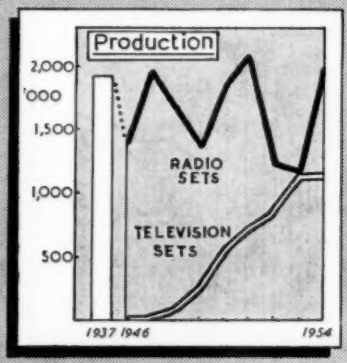


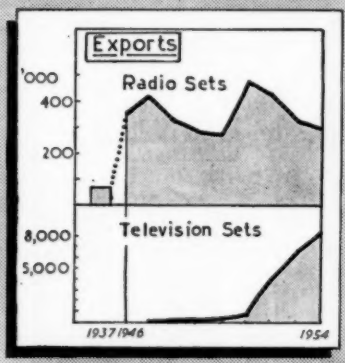
SOURCES: I.M.F. Financial Statistics
Exchange Telegraph

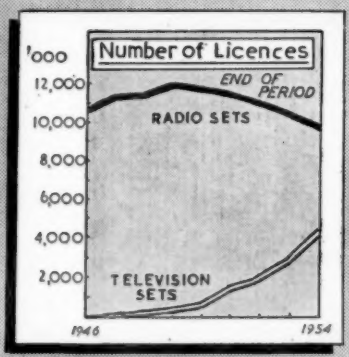
* Excluding Russia, China & E. Europe

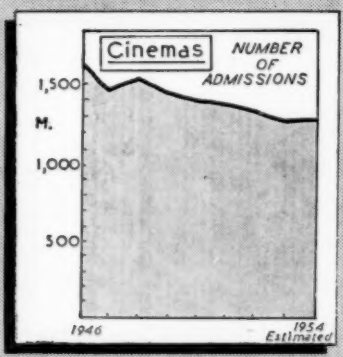
The price of gold on the London market, reopened in March last year, has since the autumn been slightly above the previous fixed price of 248/- per fine oz. In free markets abroad gold now commands virtually no premium over the official U.S. price.

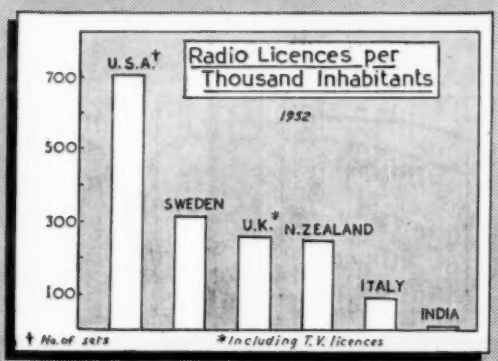
RADIO





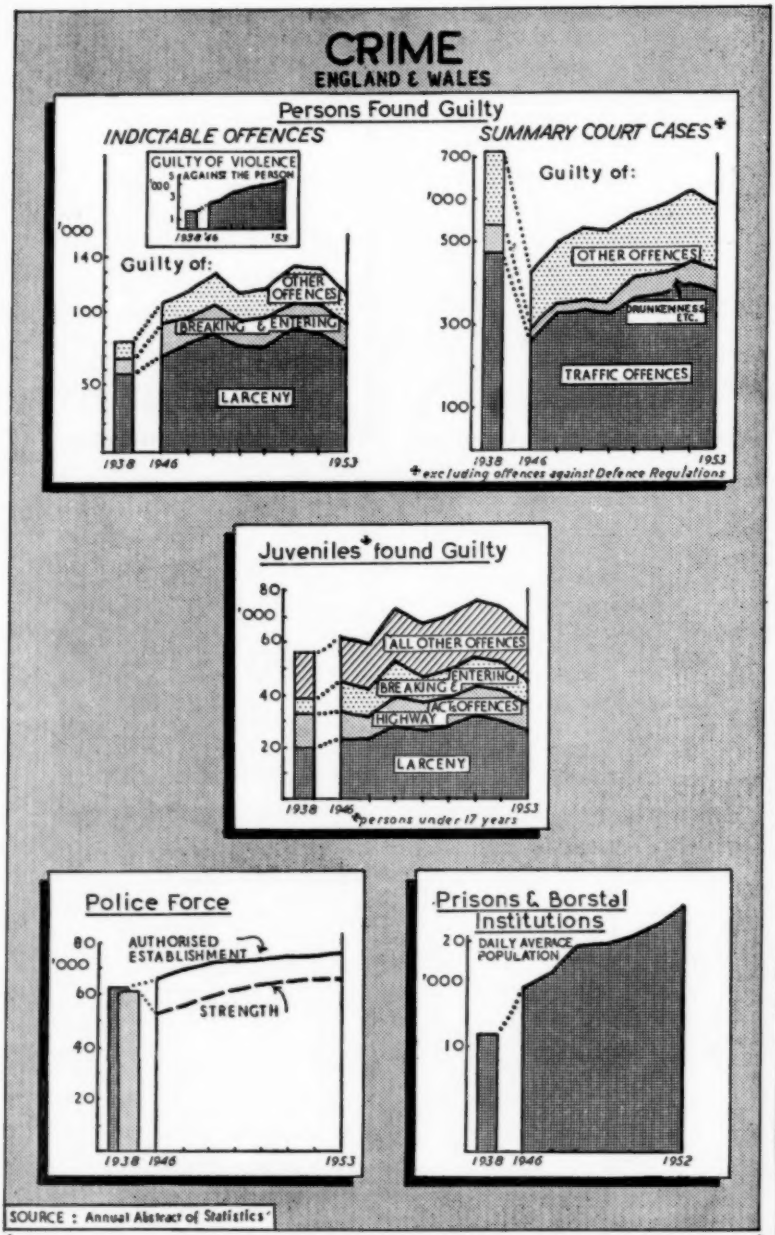






SOURCES: Annual Abstract of Statistics
Unesco Basic Facts & Figures

In 1952 there was an average of one radio set to approximately every four people in the U.K., the total number of licences (including those for T.V.) being rather less than the number of private households. In the U.S., in contrast, radio sets averaged more than two per household.



SOURCE : Annual Abstract of Statistics

The number of persons found guilty of indictable offences has declined from the 1951 peak, though the total is still above pre-war. Well over half of those found guilty in summary courts are responsible for traffic offences, the number of such cases, however, remaining appreciably lower than in 1938.